Supplementary Materials: Air

Monroe County Landfill and Landfill Gas Emissions

Aside from $PM_{2.5}$ data, there a few other sources of hard data for air emissions in the Bloomington area, one being land fill gas emissions from the Monroe County Landfill.

While the Monroe County Landfill is closed to new waste, it still emits landfill gases (LFG). LFG are comprised of about 50% of methane and 50% carbon dioxide, as well as trace amounts (~1%) of Non-Methane Organic Carbon (NMOCs), which includes some HAPs and VOCs, and some inorganic compounds, such as hydrogen sulfide, the compound pound primarily responsible for the pungent odors associated with landfills.

Facilities such as the Monroe County Landfill were not required to report greenhouse gas emissions data until 2009 (as a part of the Green House Gas Reporting Program implemented per 40 CFR Part 98 (Part 98) 2. As of January 2012, facility-level greenhouse gas data have been made available on an EPA's webpage. In 2011, the Monroe County Landfill emitted 29,394 metric tons of CO_2-equivalents LFG; in 2010 the landfill emitted about 31,118 metric tons of CO_2-equivalents LFG. It makes sense that emissions from the landfill should decrease over time given that the landfill is closed, meaning that as the contents of the landfill decompose, the overall mass of LFG-emitting waste will decrease. It should be noted that the Monroe County Landfill does not physically monitor their emissions, but rather estimates emissions based on an EPA-formula which considers the composition of the "waste-in-place" and the overall capacity of the facility (Equation HH-3). So, because the facility does not estimate emissions from direct measurements, there is likely a wide margin of error surrounding these CO_2-equivalent values.

The EPA also operates the Landfill Methane Outreach Program (LMOP) that helps connect landfill managers with engineers and other professionals to determine if a recapturing system would be a cost effective and beneficial addition to a given landfill management plan. The Monroe County Landfill is considered a "candidate project," and the landfill managers have considered investing in infrastructure to capture LFG emissions and produce energy from these gases; this energy could possibly be used to power their small on-site leachate treatment plant 3. Energy generation from methane gas both destroys the methane and other organic compounds as well as off-sets energy produced from non-renewable sources. More analysis must be done before it can determined whether implementing a project of this scale is a cost-effective investment, especially given the size of the landfill and the uncertainty in estimated LFG emissions.

Indiana University Central Heating Plant Greenhouse Gas Emissions

	Emissions (mtons)			Percent Change	
	2010	**2011**	**2012**	**2010-2011**	**2011-2012**
Carbon Dioxide	183,401.00	166,336.70	95,650.70	-9%	-42%
Biogenic Carbon Dioxide	0.00	0.00	0.00	N/A	N/A
Methane	20.00	17.44	3.67	-13%	-79%
Nitrous Oxide	2.90	2.52	0.47	-13%	-81%
Total CO2 equivalents, excluding biogenic	184,718.80	167,483.20	95,873.50	-9%	-43%
CO2 Equivalents, Biogenic	0.00	0.00	0.00	N/A	N/A

Source: Menefee, Mark. (IU Bloomington Physical Plant, Assistant Director of Utilities). Personal Communication. 20 March 2013. 4.

The emissions come from fuels burned on campus, which include coal, natural gas and oil. In 2012, Indiana University experienced a 43% decrease in emissions of carbon dioxide equivalents; this was mainly due to increased use of natural gas at the Central Heating Plant in lieu of coal as a result of dramatic price reductions in natural gas during this time 4. The emissions values reported in the table were calculated according to mass balance 5.

Due to their size, the Central Heating Plant at Indiana University is also responsible for reporting criteria pollutant emissions from their activities. The 2008 criteria pollutant levels are available in the table below. It appears that the Central Heating Plant is mostly responsible for SO_2 emissions, and also contributes to other criteria pollutant emissions in the Bloomington area to a lesser degree 1.

Criteria Pollutant	**2008 Emissions (tons)**
CO	156.0129
VOC	2.356333
NO_X	327.527
SO_2	2,306.962
NH_3	0.113919
PM_{10}	56.6828
$PM_{2.5}$	39.81622
Mercury	0.000525
Lead	0.072322

References

1. Environmental Protection Agency. “2008 National Emissions Inventory.” Last updated 3 March 2013. Available online at http://www.epa.gov/ttn/chief/net/2008inventory.html. Last accessed 4 March 2013.

2. Environmental Protection Agency. “EPA Proposes First National Reporting on Greenhouse Gas Emissions.” News release 10 March 2009. Available online at http://yosemite.epa.gov/opa/admpress.nsf/6424ac1caa800aab85257359003f5337/4bd0e6c514ec1075852575750053e7c0!OpenDocument. Last accessed 21 March 2013.

3. McGlasson, Tom. (Monroe County Solid Waste Management District, Landfill, Environmental Compliance and Safety Director). Personal communication. 7 March 2013.

4. Menefee, Mark. (IU Bloomington Physical Plant, Assistant Director of Utilities). Personal Communication. 20 March 2013.

5. Environmental Protection Agency. “Facility Level Information on Green-House Gases Total (FLIGHT) Database: 2011 Greenhouse Gas Emissions from Large Facilities, Indiana University.” Available online at http://ghgdata.epa.gov/ghgp/main.do#/facilityDetail/?q=Find%20a%20Facility%20or%20Location&st=IN&fc=18105&fid=1003713&sf=11001000&lowE=0&highE=23000000&g1=1&g2=1&g3=1&g4=1&g5=1&g6=0&g7=1&g8=1&g9=1&g10=1&s1=1&s2=1&s3=1&s4=1&s5=1&s6=1&s7=1&s8=1&s9=1&s201=1&s202=1&s203=1&s204=1&s301=1&s302=1&s303=1&s304=1&s305=1&s306=1&s307=1&s401=1&s402=1&s403=1&s404=1&s601=1&s602=1&s701=1&s702=1&s703=1&s704=1&s705=1&s706=1&s707=1&s708=1&s709=1&s710=1&s711=1&s712=1&s801=1&s802=1&s803=1&s804=1&s805=1&s806=1&s807=1&s808=1&s809=1&s810=1&s901=1&s902=1&s903=1&s904=1&s905=1&s906=1&s907=1&s908=1&s909=1&ss=&so=0&ds=E&yr=2011&tr=current&cyr=2011. Last accessed 28 March 2013.